

PERKIN-ELMER

INTELLIGENT DISK CONTROLLER (IDC) DISK FORMAT

Program

Consists of:

Program Description
Program Listing

06-268M95A15 R02
06-268M91A13 R02

06-268 R02

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PREFACE

This document describes the Perkin-Elmer Intelligent Disk Controller (IDC) Disk Format Program. It is written for customer engineers and system maintenance personnel.

Chapter 1 describes the purpose of the diagnostic, minimum hardware requirements and the program's relationship to other software. Chapter 2 outlines loading procedures. Chapter 3 details program execution. Chapter 4 is a program description of the diagnostic. Appendix A summarizes user device definitions. Appendix B explains option values. Appendix C lists input options and option printouts. Appendix D details error messages. |

Revision 02 consists of text changes. |

For information on the contents of all Perkin-Elmer 32-bit manuals, see the 32-Bit Systems User Documentation Summary.

CHAPTER 1 REQUIREMENTS

1.1 INTRODUCTION

The Intelligent Disk Controller (IDC) Disk Format program performs analysis of the entire pack. Errors encountered during the pack analysis phase cause the offending sector(s) to be alternately assigned or flagged defective when the final format is written on the pack. A listing of the results of the pack analysis is produced at the completion of the program. The list indicates:

- areas alternately assigned,
- areas flagged defective, and
- the inability to detect a previously flagged defective sector.

1.2 MINIMUM HARDWARE REQUIREMENTS

The following is a list of the minimum hardware required to run this test program:

- Perkin-Elmer Series 3200 processor (or equivalent)
- Perkin-Elmer Series 3200 Selector Channel (SELCH) or channel manager in buffered SELCH (BSELCH) mode
- IDC disk interface
- Console and list device default is a video display unit (VDU) on an RS-232C-type interface (see Appendix A).

1.3 RELATIONSHIP TO OTHER SOFTWARE

The following test programs must be run before running the formatter.

- Perkin-Elmer Series 3200 memory test
- Perkin-Elmer Series 3200 processor test
- SELCH test

The following test programs are also applicable:

- IDC disk test
- Appropriate console test
- Line printer test

CAUTION

OPTIMUM PERFORMANCE OF THE IDC DISK SYSTEM REQUIRES THE USE OF PROPERLY CERTIFIED MEDIA. THE DISK PACKS AVAILABLE FROM PERKIN-ELMER HAVE BEEN CAREFULLY SCREENED AND CERTIFIED ON A CALIBRATED DISK DRIVE TO MINIMIZE THE EFFECTS OF LATENT MEDIA DEFECTS. THIS CERTIFICATION ASSURES DISK PACK TRANSPORTABILITY AND MINIMIZES THE OCCURRENCE OF DATA ERRORS.

THE M46-786 (67MB), M46-776 (13.5MB) AND M46-787 (256MB) DISK PACKS, AVAILABLE ONLY FROM PERKIN-ELMER, ARE RECOMMENDED FOR HIGH PERFORMANCE IDC DISK SYSTEMS.

COMPATIBLE DISK PACKS CAN BE DIRECTLY OBTAINED FROM SEVERAL VENDORS AND CERTIFIED USING THE 06-268 R00 (OR HIGHER) IDC FORMAT PROGRAM. THE USER IS CAUTIONED IF THE DRIVE IS NOT CALIBRATED; THESE PACKS CAN CAUSE REDUCED SYSTEM PERFORMANCE.

SPECIFICALLY, DATA MIGHT NOT BE RECOVERABLE WHEN TRANSPORTING MEDIA BETWEEN DRIVES, OR AN OPERATING SYSTEM CRASH MIGHT RESULT DUE TO CERTAIN MEDIA DEFECTS THAT CAN ONLY BE FLAGGED ON A CALIBRATED DRIVE SUCH AS THOSE USED IN THE PERKIN-ELMER CERTIFICATION.

IN ALL CASES, WHEN USING THE IDC DISK FORMAT PROGRAM, THE PARAMETERS MUST BE SET UP EXACTLY AS SPECIFIED IN 06-268M95A15 R02.

CHAPTER 2 LOADING PROCEDURES

2.1 GENERAL

To load this program from the Perkin-Elmer Multi-Media Diagnostic System, see the Diagnostic User's Guide (50-025).

CHAPTER 3 PROGRAM EXECUTION

3.1 INTRODUCTION

See Appendix A to set up the addresses for the console input device and the list device. Execute the program at location X'0A00'. The following message is output:

```
IDC FORMATTER 06-268R02
COPYRIGHT THE PERKIN-ELMER CORPORATION 1983
ALL RIGHTS RESERVED
VALID PACTYP OPTIONS:
CE00 SPECIAL CE PACK
0  67.5MB MSM REM
   67.5MB MMD FXD
1  256MB MSM REM
2  67.5MB WINCHESTER
3  13.5MB CDD REM
4  13.5MB CDD FXD
5  40.5MB CDD FXD
6  67.5MB CDD FXD
7  268MB WINCHESTER
8  19.8MB REMOVABLE
9  19.8MB FIXED
```

3.2 OPERATING PROCEDURES

1. Manually place the format switch on the intelligent disk controller (IDC) in the FORMAT position, mount the disk pack and put the required drive on-line.
2. Enter options (see Table 3-1).
3. Type RUN to begin program execution.

TABLE 3-1 OPTIONS TO BE ENTERED

OPTION	DESCRIPTION	DEFAULT
SELCH	Selector channel (SELCH) address	X'F0'
DISCON	Disk controller address	X'FB'
DRIVE	Selects any drives 0 - 3	X'FFFF'
PACTYP	Identifies drive type and customer engineer (CE) packs	X'CE00'
LOCYL	Low cylinder address	X'FFFF'
HICYL	High cylinder address (maximum X'3FF')	X'FFFF'

CHAPTER 4 PROGRAM DESCRIPTION

4.1 INTRODUCTION

The program description provides the tests and routines for status checks and disk formatting.

4.2 TEST 0

This routine performs initial status checks of the buffered selector channel (BSELCH) and intelligent disk controller (IDC). If the status is found to be correct, a seek operation is performed to the low cylinder as specified by the user. The proper header is written to Head 0, Sector 0 of this cylinder. An improper error correction code (ECC) halfword is also written in this area. This operation is accomplished using a normal WRITE format command. A normal read data operation is then performed and a data transfer error is expected. If the proper status is found, a check of the rotational position sense (RPS) is made. The value of the RPS is expected to equal X'FE'. Finally, a normal write format is performed with the correct header and ECC character contained in the sector. This completes the test. The program will always attempt to correct the contents of Sector 0 if a program-detected error forces testing to be halted.

4.3 DISK FORMATTING (TEST 1)

This portion of the program performs the actual disk formatting. The program is divided into four phases:

1. Pack analysis
2. Clean-up format
3. Pack check
4. Final results

Common routines are utilized when convenient. However, time restraints in relation to the rotational speed of the disk during some operations require redundant in-line software coding to be used.

4.3.1 Phases

During the pack analysis phase, a halfword data pattern is written on a track utilizing the off-line write format command (X'07'). A single halfword transfer from the SELCH to the disk controller is performed. The disk controller uses this halfword and writes the complete track (routine PACSET). When the disk controller asserts its idle status, the content of the RPS register is read. If the complete transfer has occurred, the RPS equals zero. The next operation performs an off-line read format (X'04'). This read is performed nine times. The actual read count indexes into an offset table. On each pass, the content of the RPS register is checked to ensure a full track has been read. If the examine status bit is set on the disk controller, a message is logged on the console device and the operation is aborted. If the status from the controller reflects a data transfer error, the file status is then tested. If the file status is zero, the ECC error is valid; a nonzero status indicates a file problem. In the latter case, the error is logged and the test aborted. If an ECC error is found, the content of the RPS register is obtained and the number minus one is used to index a byte in the track table (TRKTBL). The content of this byte is incremented by one. When all reads are complete, the data pattern is rotated one bit position to the right and the whole process repeated.

When all data shifts have been performed, the content of the TRKTBL is examined. A TRKTBL containing all zeros indicates an error-free track, and the clean-up format phase is entered. If errors are found, the alternate sectoring software is entered. The following rules are used to alternate a sector:

- If a single error is found, the sector is alternated.
- If multiple sectors are found to contain errors, the highest numbered sector is alternated and all other sectors are flagged defective.

The layout of the track is contained in the TRKTBL, where each byte represents one sector. This table is then used to perform the actual formatting and testing. The format of a track is written during the clean-up format phase of the program (FMWRT). This is done using a normal write format operation (command X'06'). A normal read (command X'01') is then performed using the same scheme as described above. Any data transfer errors detected during this phase, when the file status is zero, will cause the program to perform one of three actions.

1. The sector containing the error has not been previously altered; however, a sector that has been altered already exists on the track and this marginal area is flagged defective.
2. If the offending sector is the same physical sector that was originally alternated, all sectors containing errors are flagged defective and the whole track is rewritten.
3. If the track contains no previously detected errors, the entire track is rewritten and the offending sector is alternated.

Upon completion of the read, the program advances to the next track and repeats the process. When the highest cylinder has been formatted, the program enters the pack check phase. In this phase, each track is tested by doing a read check operation (command X'03'); this checks the format integrity. The last phase of the format process lists the final results accumulated during formatting. If no marginal areas have been found on the pack, the program halts and the format process is completed. The items contained in the list are tabulated according to their types; i.e., alternate sectors allocated, sectors flagged defective and sectors that could not be flagged defective. When this listing is complete, the format program halts.

4.4 PROGRAM NOTES

The following items are an analysis of test results found after running test programs:

- A failure detected while running Test 0, causing the format program to abort, could leave a sector on the IDC disk with an illegal ECC character. To run any test program using this sector, the format scope loop of the IDC Disk Test Program must be run prior to any other tests.
- A hardware failure that occurs during the pack analysis phase of Test 1 can cause the program to abort. This portion of the program has performed an off-line write format to the track and has obliterated legitimate sector addresses. The format scope loop of the IDC Disk Test Program should be run prior to running any tests to isolate the failure.
- Test programs that perform write format operations will not preserve the findings of the IDC disk format program. If it is necessary to run write format operations on tracks that have sectors alternately assigned or sectors flagged defective, the IDC Disk Format Program should be run on the affected areas.

- Program execution times are heavily dependent on instruction execution time. Deviations of instruction execution times can cause increased program completion time as each missed sector in a given program sequence will cause an additional revolution of the disk.

The minimum time to program completion is:

- 4.1 hours for a 67Mb IDC disk, and
 - 14.0 hours for a 256Mb IDC disk.
-
- The inability of a sector to be flagged defective will be listed in the final result table, but does not halt the format process. The disposition of the disk pack is left to the user's discretion (see Perkin-Elmer Specifications 24-079 A10 or 24-080 A10).
 - The number of sectors flagged defective cannot exceed the pack specification (see Perkin-Elmer Specifications 24-079 A10 or 24-080 A10). The format program can accumulate only a total of 150 entries. When the number of entries reach this level, the program will print all entries contained in the final results table and then abort testing. At the user's option, the format program can be restarted, inputting a new LOCYL equal to the cylinder number being formatted when the program halted.
 - The console indicates the track/cylinder being processed.

APPENDIX A USER DEVICE DEFINITION

A.1 ASCII INPUT/OUTPUT (I/O) DEVICE SUPPORT

The Executive of the program uses the concept of console I/O and list device. The console I/O device is an interactive device capable of logging messages and accepting commands and other user input. When the Executive is accepting input from the user or sending messages to the user, the console device is used. When the test program is running, the list device is used for logging messages.

A.2 INPUT/OUTPUT (I/O) HALFWORD CONTROL OF I/O DEVICE SELECTION

The list and console device are specified to the Executive by the contents of the halfword IO at X'0A10'. The interpretation of this data is detailed in Table A-1. The Executive allows only the identifiers shown and changes illegal identifiers to X'01'.

TABLE A-1 I/O IDENTIFIERS

CONSOLE DEVICE IDENTIFIER (BITS 0-7)	LIST DEVICE IDENTIFIER (BITS 8-15)
X'01' - Video display unit (VDU) on PASLA or communications multiplexor (COMM MUX) interface	X'01' - VDU on PASLA or COMM MUX interface
X'02' - Device on current loop interface (CLI)	X'02' - Device on CLI
X'03' - Reserved - changed to X'01'	X'03' - Line printer on line printer interface
X'04' - Device on PASLA or COMM MUX interface	X'04' - Device on PASLA or COMM MUX interface

A.3 INPUT/OUTPUT (I/O) DEVICE ADDRESSES AND CHARACTERISTICS

The device types implied by the values contained in the IO halfword are described in the following paragraphs. For each of the devices, including device type X'03', termination of an output line results in a carriage return (CR), line feed (LF) and null character being output by the Executive (X'0D', X'0A', X'00').

Devices identified by X'01' are assumed to be on a full-duplex, asynchronous RS-232C-type interface with addresses X'010' and X'011' for read and write sides, respectively. Examples of such interfaces are: PASLA, COMM MUX or multiperipheral controller (MPC). The Executive programs these devices for highest clock rate, seven data bits, two stop bits and even parity. If the terminal is set up differently, location CRT2ND must be modified accordingly. Line break status is assumed to be indicated by framing error status, with BUSY not active and a zero character in the receive buffer. Off-line status is assumed to be X'0C' (BUSY + EXAMINE STATUS) in the read mode and X'48' in the write mode (CL2S NOT + BUSY).

Devices identified by X'02' are assumed to be on a teletype (TTY) compatible CLI with address X'002'. The Executive programs these devices for unblocked mode (Echoplex). Line break status is assumed to be indicated by framing error status. Off-line status is assumed to be X'01' (device unavailable). If this bit is set, other status bits are don't-cares.

The list device identified by X'03' is assumed to be a line printer on a line printer interface with address X'062'. Off-line status is assumed to be X'01' (device unavailable). If this bit is set, other status bits are don't-cares.

Devices indicated by X'04' are assumed to be attached as described for device type X'01', having the capability of transmitting DC4 and DC2 transmission pause and resume requests. An example of such a device is the Perkin-Elmer Carousel 300 terminal.

A.4 SELECTING DEVICES BEFORE STARTING EXECUTION

The IO halfword described above controls which device identifiers are used when the program is started. The default data in this halfword is X'0101'. If this value does not indicate the desired type of I/O device of the types supported, the data in the IO halfword can be modified before starting program execution.

If the default device addresses are not the addresses of the devices configured in the system, the table of device addresses found in the source program adjacent to the IO halfword can be modified. There are two halfword entries used for each type device. The first is the read side address and the second is the write side address. Both of these halfwords must be modified for any change required. If the device type has only one address (a line printer), the device address must be placed in each of the two appropriate halfwords. The Executive always uses the read side address to test off-line status.

A.5 OPTION/COMMAND INPUT STRUCTURE

An asterisk (*) is output to the console device to indicate that the program is awaiting option input. Any option can be typed in from the console input device, followed by a space and the desired hexadecimal value. A carriage return (CR) is issued to terminate every option/command input. An invalid option/command or value will cause a question mark (?) followed by a CR, a line feed (LF) and an asterisk (*) to occur.

APPENDIX B OPTION VALUES

Examine each option in Table B-1 and read each description. If the default value specified is the value desired, no action is necessary. If the default value is not specified or is not the desired value, the option must be entered. See Appendix A for command input structure.

NOTE

All numeric input and output is hexadecimal (base 16).

TABLE B-1 OPTIONS TABLE

OPTION	MANDATORY ENTRY=X	DEFAULT VALUE	DESCRIPTION
Test	No	0 and 1	Specifies test to be run Test 0 - Basic controller tests Test 1 - Pack format
LOCYL	X	X'FFFF'	Establishes the low cylinder address (HEX) for the formatting process. LOCYL must not be greater than the HICYL option or greater than the number of cylinders referenced by the PACTYP option.
HICYL	X	X'FFFF'	Establishes the high cylinder address (HEX) for the formatting process. HICYL must not be less than LOCYL option and must not be greater than the number of cylinders referenced by the PACTYP option.
DRIVE	X	X'FFFF'	Defines which drive connected to the disk controller is to be used for formatting. The possible drives are 0, 1, 2 or 3 corresponding to disk 1, 2, 3 or 4, respectively.

TABLE B-1 OPTIONS TABLE (Continued)

OPTION	MANDATORY ENTRY=X	DEFAULT VALUE	DESCRIPTION
SELCH		X'00F0'	Establishes selector channel (SELCH) address
DISCON		X'00FB'	Defines disk controller address
PACTYP	X	X'CE00'	Identifies the pack type being formatted Type CE00 identifies a customer engineer (CE) pack. This type of pack will not be formatted by this program. The following options are available: 0000 - 67Mb Mass Storage Media (MSM) Pack 0001 - 256Mb MSM Pack 0002 - 67Mb MSM Winchester (HPT option) 0003 - 16Mb Cartridge Media Drive (CMD) Removable 0004 - 16Mb CMD Fixed 0005 - 48Mb CMD Fixed 0006 - 80Mb CMD Fixed 0007 - 300Mb CMD Fixed 0008 - 19.8Mb Removable 0009 - 19.8Mb Fixed
OPTION			This input parameter causes the software to list all user input parameters.
RUN			This input command causes the program to begin execution.
CON			This input command causes the microcode console routine to be entered.
@			This input command causes the microcode console routine to be entered.

APPENDIX C
INPUT OPTIONS AND OPTION PRINTOUTS

OPTION PRINTOUT AFTER INITIAL PROGRAM LOAD:

```
DISCON  00FB
SELCH   00F0
PACTYP  CE00
LOCYL   FFFF
HICYL   FFFF
DRIVE    FFFF
```

INPUT PROGRAM OPTIONS:

LOCYL 0

HICYL 336 Maximum cylinder number for 67Mb and 256Mb is
 X'336' (823 cylinders), X'393' for Winchester,
 X'3FF' for 300Mb and X'26F' for 19.8Mb fixed
 and 19.8Mb removable.

PACTYP X X = 0 67Mb
 X = 1 256Mb
 X = 2 67Mb Winchester with head per track
 (HPT)
 X = 3 16Mb cartridge media drive (CMD)
 removable
 X = 4 16Mb CMD fixed
 X = 5 48Mb CMD fixed
 X = 6 80Mb CMD fixed
 X = 7 300Mb CMD fixed
 X = 8 19.8Mb removable
 X = 9 19.8Mb fixed
 X = CE00 Customer engineering disk pack

DRIVE 0

RUN

PROGRAM PRINTS THE FOLLOWING IF NO MARGINAL MEDIA AREAS LOCATED:

TEST 00 Pack Serial Number
TEST 01
DRIVE 0 SELECTED

XXXX Where XXXX is the cylinder being formatted

END OF TEST
NO ERROR

PROGRAM PRINTS THE FOLLOWING IF MARGINAL MEDIA AREAS ARE IDENTIFIED:

TEST 00
TEST 01

XXXX Where XXXX is the cylinder being formatted

ALTERNATE SECTORS CREATED

CYLINDER	HEAD	SECTOR	
003	04	015	LBA 004D5
005	04	015	LBA 00755

DEFECTIVE SECTORS FLAGGED
NONE

SOFT ERRORS
NONE

** NO DEFECTIVE FLAG **
NONE

END OF TEST
NO ERROR

NORMAL OPTIONS FOR PACTYP 0 TO 9:

PACTYP 0

DISCON 00FB
SELCH 00F0
PACTYP 0000
LOCYL 0000
HICYL 0336
DRIVE 0000

PACTYP 3

DISCON 00FB
SELCH 00F0
PACTYP 0003
LOCYL 0000
HICYL 0336
DRIVE 0000

PACTYP 6

DISCON 00FB
SELCH 00F0
PACTYP 0006
LOCYL 0000
HICYL 0336
DRIVE 0000

PACTYP 1

DISCON 00FB
SELCH 00F0
PACTYP 0001
LOCYL 0000
HICYL 0336
DRIVE 0000

PACTYP 4

DISCON 00FB
SELCH 00F0
PACTYP 0004
LOCYL 0000
HICYL 0336
DRIVE 0000

PACTYP 7

DISCON 00FB
SELCH 00F0
PACTYP 0007
LOCYL 0000
HICYL 0336
DRIVE 0000

PACTYP 2

DISCON 00FB
SELCH 00F0
PACTYP 0002
LOCYL 0000
HICYL 0393
DRIVE 0000

PACTYP 5

DISCON 00FB
SELCH 00F0
PACTYP 0005
LOCYL 0000
HICYL 0336
DRIVE 0000

PACTYP 8

DISCON 00FB
SELCH 00F0
PACTYP 0008
LOCYL 0000
HICYL 026F
DRIVE 0000

PACTYP 9

DISCON 00FB
SELCH 00F0
PACTYP 0008
LOCYL 0000
HICYL 026F
DRIVE 0000

APPENDIX D
ERROR MESSAGES AND ERROR DICTIONARY

Unrecoverable errors result in the printing of the following messages:

```
ERROR 00FN
DEV DDD STA SS
PSW PPPP LOC LLLL
```

```
or ERROR 00FN
PSW PPPPPP LOC LLLLLL
STATUS - XXXXXXXX
```

Where:

00F1	is the arithmetic fault interrupt.
00F2	is the illegal instruction interrupt.
00F3	is the machine malfunction (MMF) interrupt (see Note).
00F4	is the spurious device interrupt.
00F5	is the relocation/protection interrupt.
00F6	is the input/output (I/O) interrupt level error.
00F7	is the data format fault.
DDD	is the device address returned when the interrupt occurred.
SS	is the status of the interrupting device.
PPPPPP	is the least significant 24 bits of program status word (PSW) when the interrupt occurred.
LLLLLL	is the least significant 24 bits of PSW location when the interrupt occurred.

XXXXXXXX is the interrupt reason code.

NOTE

For the MMF interrupt, the last 4 bits of STATUS define the type of failure, as follows:

X100	Parity error on data fetch
0010	Parity error on instruction fetch
X001	Power fail
0000	Power restore
1X0X	Parity error or power fail during an auto-driver channel operation (32-bit processors only)

PROGRAM OPERATION ERRORS

Format

Error OXYZ (see Error Dictionary)

DEV DDD STA S1 S2 S3
CYLINDER TTT HEAD HH SECTOR KKK OFFSET LL DATA MMMM

Where:

DDD	is the device address of offending device.
S1	is the selector channel (SELCH) status.
S2	is the disk controller status.
S3	is the disk file status.
TTT	is the track number.
HH	is the head number.
KKK	is the sector number.
LL	is the offset.
MMMM	is the data pattern.

ERROR DICTIONARY

Ex Field Error Dictionary

0. Basic test
1. Format processing

Ey Field Error Dictionary

0. Check of initial status
1. Seek prior to a command
2. Seek after command
3. Restore prior to command
4. Restore after command
5. Off-line read format
6. Normal write format
7. Normal read
8. Off-line write format
9. Attempting to flag defective sector after performing a normal read
 - A. Read check
 - B. Doing offset (strobe/track) commands
 - C. SELCH error
 - D. Normal read format
 - E. Expected error correction code (ECC) error not received

PROGRAM OPERATION ERRORS

22 Field Error Dictionary

1. File status bad
2. Time-out
3. Disk controller error
4. Disk controller error-forced defective sector
5. Off-line read format error utilizing offsets
6. Disk controller error-writing bad ECC
7. Solid read error
8. Illegal sector address
9. SELCH final address incorrect
- A. File status bad-read check initialization
- B. Rotational position sense (RPS) incorrect
- C. Expecting error received none
- D. SELCH error

APPENDIX E MESSAGE SUMMARY

Messages that may be output during execution of this program are summarized below. See Section 4.1 for additional information.

Messages:

INVALID XXXXXX OPTION

This message is printed when an option requested is invalid or a mandatory option is missing. XXXXXX indicates the erroneous option.

CE PACK INSTALLED

This program will not attempt any format operation on a CE disk pack. See PACTYP commands.

DRIVE WRITE PROTECTED

This message is printed when the selected drive returns write-protect status. The user should depress the protect button on the appropriate disk drive's control panel to turn the indicator off.

FORMAT SWITCH NOT ENABLED

This message is printed if the switch on the disk controller is not in the format position.

DEFECTIVE SECTORS EXCEED SPECIFICATION

This message is printed if more than 150 problem areas on the pack have been identified. The user, at his option, can restart the program to format the remaining portion of the pack. Prior to starting the program, the user should set the low cylinder (LOCYL XXXX) to the highest cylinder number found in the Final Results List. Type RUN to begin the format process.

DRIVE X SELECTED

This message is printed to indicate which drive is being used. X can be any number from 0 to 3 to indicate 1 to 4 drives, respectively.

FINAL PACK LISTING

Upon completion of the formatting process, the results of pack analysis performed are printed. The printout itemizes all areas of the pack that contained flaws and the operation performed by the program. Appended to each entry in this listing is a logical block address (LBA), which is the hexadecimal, consecutive sector number of the entry starting from zero (cylinder 0, head 0, sector 0). If no marginal areas are detected during the course of program execution this will not be printed. The list headings for the flaws are as follows:

Alternate Sectors Created

Sectors that have been moved to alternate areas on the track

Defective Sectors Flagged

Sectors that have been flagged defective

** No Defective Flag **

Sectors that were found defective but could not be flagged

SOLID ERROR

This message is printed to indicate that an irrecoverable error has occurred within the hardware.

TEST XX ABORTED

This message is printed when the format program has detected a hardware malfunction and cannot continue operating. XX contains the subtest number of the test running at the time of the failure.

****TRACK XXX HEAD YY BAD

This message is output to the console device indicating that an area on a given track is defective and cannot be flagged. XXX indices the cylinder number and YY defines the head. It is the user's option to allow the format program to continue its operation.

END OF TEST

This message is printed when the format program has completed its operation.